

State of Minnesota  
Minnesota Pollution Control Agency

In the Matter of Proposed  
Amendments To Minnesota Rules  
Chapters 7050 and 7053 for Rule  
Amendments Governing Water  
Quality Standards- River  
Eutrophication, Total Suspended  
Solids and Minor Corrections.  
OAH Docket # 60-2200-30791,  
Revisor ID # 4104.

Staff Rebuttal Response to MESERB  
and MSGA Public Comments

February 20, 2014

MPCA Rebuttal Response to Two Specific Comment Letters Submitted during the Post-hearing  
Comment Period (MESERB and MSGA).

**I. Introduction**

This memorandum is the Minnesota Pollution Control Agency's (MPCA or Agency) post-hearing rebuttal response (Rebuttal) to two public comments not previously addressed in the MPCA Staff Post-Hearing Response to Comments filed with the Office of Administrative Hearings on January 28, 2014 (1/28/14 Response), or the MPCA Staff Post-Hearing Rebuttal Response to Public Comments filed with the Office of Administrative Hearings on February 4, 2014 (2/4/14 Rebuttal). Specifically, this Rebuttal responds to comments in Hearing Exhibits HE-8-20, HE-8-20A, HE-8-20B (Minnesota Environmental Science and Economic Review Board (MESERB)) and HE-8-21 (Minnesota Soybean Growers Association (MSGA)).

Most of the comments in Hearing Exhibits HE-8-20, 20A, 20B (MESERB) repeat, provide specificity to, or provide new aspects to comments previously addressed in MPCA's 1/28/14 Response and 2/4/14 Rebuttal. There are two new issues raised by comments in Hearing Exhibits HE-8-20B (MESERB) and HE-8-21 (MSGA). Section II. of this memorandum addresses new aspects of issues previously addressed; and Section III. addresses the two new issues.

**II. Response to issues previously addressed**

This section addresses comments in HE-8-20 and 20B (MESERB). MPCA is not responding directly to HE-8-20A which contains a copy of the proposed rule with hundreds of comment boxes inserted. After review of the comment boxes, MPCA concluded the content is largely repeated and organized in HE-8-20 and 20B. This section provides responses only to new aspects of general categories of comments that were also addressed in the MPCA's 1/28/14 Response and 2/4/14 Rebuttal. The general categories of comments are:

- A. Comments regarding the scope of protection provided by the standards;
- B. Comments regarding biochemical oxygen demand (BOD<sub>5</sub>) and dissolved oxygen (DO) flux;
- C. Comments regarding the use of periphyton as a variable;
- D. Comments requesting separate standards for large and small rivers;
- E. Comments regarding proposed eutrophication standards for the Red River of the North; and
- F. Comments regarding cost analysis.

MPCA staff diligently reviewed comments in HE-8-20B (MESERB) prepared by Hall and Associates. The review resulted in an inventory documenting a large number of errors, misdirection, and unfounded assertions. This memorandum does not burden the record with the entire inventory, but rather focuses on only the most concerning of the errors. One recurring technique used throughout MESERB's comments is isolating a small element of the rule or supporting analysis in order to disparage the larger integrated rule, integrated water quality standard, or larger integrated analyses. The comments are without merit because many of the criticisms are asserted without substantiation, are inaccurate or are erroneous. They ignore the context of the full standard (i.e., a phosphorus stressor criteria coupled with a response parameter), and the multiple lines of evidence which were used in conjunction with one another to develop the proposed criteria. For example, MESERB criticizes the use of the response variables BOD<sub>5</sub> and DO flux because they are affected by other non-nutrient factors (e.g., stream morphology, residence time, etc.). The same is true of chlorophyll-a; however, MESERB does not oppose this response variable. MESERB's argument is further flawed by considering the BOD<sub>5</sub> and DO flux criteria independently. This approach misses the intent of the standard that both a cause variable (i.e. phosphorus) and a response variable are necessary to establish an impairment. MESERB suggests the removal of tools that the MPCA and others have demonstrated to be useful determinants of enrichment leading to eutrophication in rivers and streams. The proposed integrated river eutrophication water quality standards are fully supported by extensive analyses and are specifically protective of Minnesota's aquatic life use goals.

**A. Comments regarding the scope of protection provided by the standards**

**a. Relationship of proposed water quality standards to aquatic life use goals**

Comments HE-8-20 and 20B (MESERB) request that MPCA re-examine its modeling and establish thresholds based on the attainment and maintenance of designated beneficial uses, as required under the federal Clean Water Act and state law. MESERB asserts that "the analysis used by the MPCA bears more relation to administrative and mathematical convenience than to ecological conditions." Comment HE-8-20B attempts to discredit MPCA's analyses by

questioning the use of specific biological metrics and the analyses used to identify thresholds in these biological communities.

The analyses used by MPCA are fully consistent with Minnesota water quality laws<sup>1</sup> and the Clean Water Act (CWA).<sup>2</sup> Specifically, the analyses were selected to identify thresholds that would protect Minnesota's aquatic life use goals, and thereby, support the CWA interim goal. The CWA interim goal is:

*"wherever attainable, an interim goal of water quality which provides for the protection and propagation of fish, shellfish, and wildlife and provides for recreation in and on the water."<sup>3</sup>*

Minnesota Rule § 7050.0150 subp. 3, provides a narrative description for the protection of biological communities in Class 2 waters:

*"The normal fishery and lower aquatic biota upon which it is dependent and the use thereof shall not be seriously impaired or endangered, the species composition shall not be altered materially, and the propagation or migration of the fish and other biota normally present shall not be prevented or hindered by the discharge of any sewage, industrial waste, or other wastes to the waters."*

MPCA interprets the losses of species (i.e., fish, macroinvertebrates, and other organisms associated with aquatic habitats) and changes in the structure and function of these communities as measured by biological metrics (see EU-1, Table 11) to be in violation of the these goals.

MPCA reasonably used quantile regression and changepoint analyses to identify shifts in biological communities that correspond to a significant loss in the structure and function of those communities. Identification of thresholds and the subsequent setting of nutrient goals were deliberately designed to protect against losses of important biological attributes. Furthermore, the thresholds that the MPCA identified (see EU-1, Appendix IV) are consistent with stressor-response thresholds used to identify nutrient criteria by Dr. Stevenson and four U.S. Environmental Protection Agency (EPA) staff members (Stevenson et al. (2008)). Figure 2 as referenced in SONAR<sup>4</sup> Book 2, Exhibit EU-1, p. 31, and included as Figure 1 below, demonstrates the approach. One of the EPA staff members, Dr. Stevenson, was among the three EPA-contracted reviewers of MPCA's draft Technical Support Document (TSD) on this rule as noted in SONAR Book 2, Exhibit EU-24b. EPA staff member Dr. Lester Yuan co-authored EPA guidance to the states on use of stressor-response relationships (SONAR Book 2, Exhibit EU-20).

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<sup>1</sup> Minn. R. chs. 7050 and 7052 (2013).

<sup>2</sup> 33 U.S.C. §1251, et seq.

<sup>3</sup> 33 U.S.C. §1251(a)(2).

<sup>4</sup> Statement of Need and Reasonableness (Hearing Exhibit HE-3).

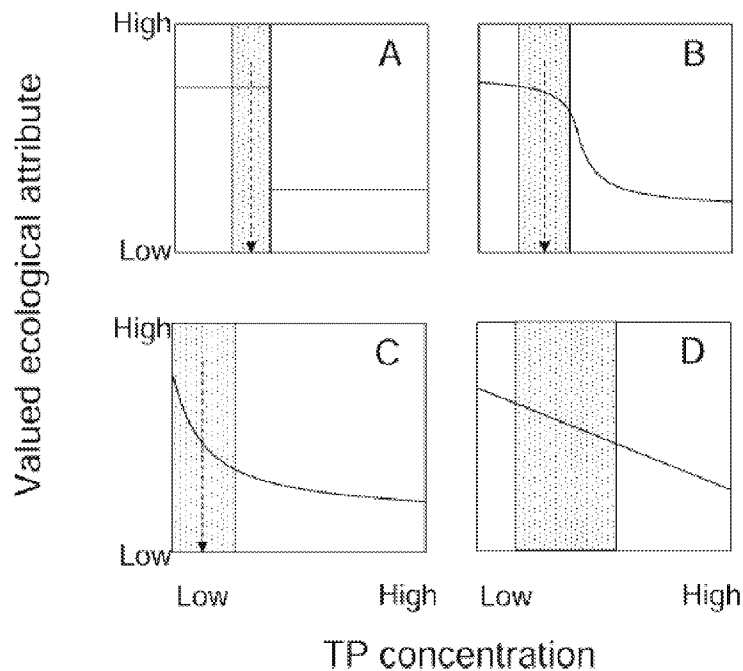


Figure 1: Approaches to development of stressor criteria when potential responses of valued ecological attributes to stressors (e.g., total P [TP]) are nonlinear with assimilative capacity for increases at low levels the stressor (A, B), nonlinear with strong sensitivity to changes at low levels of the stressor (C), and linear (D). A stressor criterion is established at a level of a stressor that protects the valued ecological attribute. Arrows indicate TP criteria justified on the basis of the form of the stressor–response relationship. Shaded areas indicate the range of TP criteria that could be acceptable. Acceptable ranges vary as a function of the linearity of the stressor–response relationship and the type of nonlinear relationship. (Figure 2 from Stevenson et al. 2008)

In MPCA's 1/28/14 Response additional analysis was provided demonstrating the biological measure values identified by the quantile regression analysis were similar to streams where aquatic life use goals were met. This additional analysis was undertaken in response to a comment (HE-8-8 MCEA) that supported the use of quantile regression analyses to identify biological thresholds, but felt that the thresholds chosen by MPCA were too high and could result in under protective criteria. SONAR Book 2, pgs. 82-85, also supports the conclusion that the analyses used and the resulting proposed criteria are in line with Minnesota's aquatic life use goals. This analysis demonstrated that streams (both wadeable and nonwadeable) that exceed the proposed river eutrophication nutrient criteria are very unlikely to meet protection goals for fish and invertebrates.

Comment HE-8-20B criticizes the thresholds developed by using biology in isolation without giving consideration to the other multiple lines of evidence used by MPCA to determine the criteria, and specifically ignores that reference condition analysis are also used. For example, the results of reference condition analysis and biological threshold analysis are very similar for the North and Central regions (SONAR Book 2, Exhibit EU-1, Tables 21 and 22). The reference

condition analysis is a recommended EPA approach (see SONAR Book 2, Exhibits EU-10, 11, 12 and 14) and comment HE-8-20B provides no criticism of the reference condition approach.

As shown throughout the SONAR, in the presentation and responses by MPCA at the rule hearing and through subsequent MPCA responses to comments, the proposed water quality standards are based on sound science and protective of aquatic life uses as required by the Clean Water Act and Minnesota law.

b. EPA Science Advisory Board advice regarding use of changepoint analysis

Comment HE-8-20 (MESERB) states that the proposed river eutrophication standards are based on an analysis which EPA's Science Advisory Board (SAB) cautioned against using.

The use of changepoint analysis is supported by EPA (Exhibit HE-8-3) and the MPCA correctly and reasonably applied it in the development of the proposed standards as described in MPCA's 1/28/14 Response, Section IV. C. In Exhibit HE-8-3, EPA states:

*"Based on the experts' comments in total and our independent review of the proposal, Region 5's preliminary evaluation is that the technical components of Minnesota's proposed eutrophication standards under peer review for rivers and streams appear to be scientifically defensible and EPA remains supportive of the state's efforts to develop eutrophication standards."*

The critiques offered by the SAB, as cited in the MESERB comment, are specifically directed at EPA as they developed guidance for states. The SAB does not speak to the use of the subsequent EPA guidance by states. MPCA followed EPA guidance and EPA was fully aware of the critiques offered by the SAB as it reviewed MPCA's proposed rules and found them "scientifically defensible."

MPCA understood the cautions provided by the SAB, which is why the MPCA considered the biological significance of shifts in the biological metrics along the continuum of phosphorus concentrations in the changepoint analysis. MPCA also used quantile regression as a basis for identifying thresholds. These combined techniques provided thresholds that were used as the basis for the final proposed criteria. In addition, these biological analyses were supported by other lines of evidence as recommended by the SAB report (SONAR Book 2, Exhibit EU-20). States are directly responsible for following EPA guidance, informed by the SAB report. Minnesota reasonably followed EPA guidance. EPA has firmly supported all of Minnesota's efforts and conclusions in the development of river eutrophication standards.

c. EPA reviewer comments

Comment HE-8-20 (MESERB) identifies a number of comments made by third-party reviewers engaged by EPA that criticize MPCA's use of changepoint analysis and quantile regression in the development of the proposed eutrophication standards.

MESERB's comments mischaracterize the reviews (HE-8-8-3) by using selective quotes, which, when considered independently, appear to be critical of MPCA's approach. Overall, the EPA reviewers are complimentary and supportive of MPCA's approach.<sup>5</sup> The reviewers do provide a number of criticisms and offer recommendations on some technical aspects of the analyses which fall in to three groups. First, there were recommendations with which MPCA agreed and addressed as part of its standards development process. Second, there were recommendations that are valid, however, were not feasible to follow due to available datasets or specific conditions in Minnesota. Third, there were recommendations with which MPCA did not agree because they were either not applicable or flawed in their reasoning.

An example of the third group highlighted in comments HE-8-20 and 20B are the assertions that MPCA selected thresholds that had no significance or relationship to attainment of biological goals. As stated in section II. A. of this memorandum and the SONAR Book 2, Exhibit EU-1, the MPCA identified thresholds meeting the CWA interim goals for the protection of aquatic life biological goals. MESERB's comments also display a misunderstanding of the analyses used by MPCA. In all cases, MPCA performed a significance test to determine if the threshold was statistically significant (SONAR Book 2, Exhibit EU-1, pgs. 32-34). All thresholds chosen by MPCA were statistically significant.

The MPCA addressed the confounding factors comment raised by one of the EPA reviewers in this document (see section II. B. a., below) and in MPCA's previous response to comments.

The MPCA responded to similar MESERB comments in its 1/28/14 memorandum at Section IV. C. In regard to the specific citations referenced in HE-8-20, MPCA acknowledges that the peer reviews contained some criticisms of an admittedly complex process that is even debated between reviewers, but draws attention to the conclusion statements of each of the EPA commenters.

**B. Comments regarding biochemical oxygen demand (BOD<sub>5</sub>) and dissolved oxygen (DO) flux**

Comments HE-8-20 and 20B (MESERB) state that the MPCA's proposal is not reasonable because of the inappropriate use of TP, BOD<sub>5</sub> and DO flux; and because of the MPCA's failure to consider confounding factors. The MPCA responded to these comments in its 1/28/14

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<sup>5</sup> Excerpts from Exhibit HE-8-3, Jan. 7, 2014, letter from EPA Region V- Linda Holst.

"Reviewer #1. Overall, this document represents a thorough look at nutrient effects in Minnesota Rivers."

"Reviewer #2. Overall summary: Minnesota has used thresholds and quantile regression for determination of nutrient criteria to protect and propagate fish, shellfish, and wildlife. These are valuable techniques and the additive quantile regression smoothing is a particularly valuable approach."

"Reviewer #3. Minnesota has done a clearly admirable job - thorough, in-depth, thoughtful, linked, well documented, and is one of the more impressive TSDs I have seen for streams, which have agreeably become thorny systems for which to develop criteria. The MPCA effort is impressive. My comments here should not be completely interpreted as suggesting the package is not defensible. I think it can stand."

Response memorandum at Section IV. C., and Attachment IV. For convenience only, the following notes previous responses to each of the comments.

a. Confounding factors

A response to comments regarding the MPCA's consideration of confounding factors was provided in the MPCA's 1/28/14 Response, Attachment I (spreadsheet), line 200.<sup>6</sup> The MPCA also responded to the issue of confounding factors analysis in its 2/4/14 Rebuttal at Section II. D. a.<sup>7</sup>

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<sup>6</sup> "The MPCA addressed these confounding factors using several methods. First, a review of the literature which includes many decades of research documents the well established impacts of nutrients on biological communities (see EU-1 pp. 3-7). In fact these relationships have also been supported by commenters to this rule. Second, EU-1 - Fig 9 demonstrates that although there is a relationship between total phosphorus and total suspended solids and habitat (as measured by the Minnesota Stream Habitat Assessment tool [MSHA]), there are many streams that lack these stressors but still have elevated concentrations of total phosphorus. Despite this, MPCA did not observe streams with high concentrations of total phosphorus with healthy biological communities. This indicates that in the absence of these other stressors, phosphorus is still negatively impacting the biological communities. Finally, the use of quantile regression minimizes the effect of covarying stressors. This method fits the outside of the data plot and thereby is fitting the response of the biological community to the stressor of interest. A more detailed description of this can be found in EU-1 p. 26."

<sup>7</sup> "Comments HE-8-14 (MCSC), HE-8-16 (MCES) and the hearing testimony of John Hall, request MPCA perform what they label a "Confounding Factors Analysis." The concern expressed is that additional covarying factors could be driving the biological response and obscuring the response to the stressor of interest (in this case TSS, total phosphorus, chlorophyll-a, BOD<sub>5</sub> or DO flux). The following list summarizes the methods used by MPCA to develop the water quality standards and the conclusions of those methods.

- 1) A literature review...
- 2) The MPCA developed a conceptual model of the impacts of nutrients on biological communities (SONAR Book 2, Exhibit EU-1, Figure 1) and collected data to empirically test this model...
- 3) The relationship between other major stressors and total phosphorus was assessed to determine how and if these stressors covary...
- 4) The MPCA used analyses that minimized the impacts of covarying stressors (i.e., quantile regression and changepoint) to identify biological thresholds from field-collected data... The Minnesota Cities Stormwater Coalition (MCSC) quotes the Total Suspended Solids Technical Support Document (SONAR Book 3, Exhibit TSS-1) out of context as evidence that field collected data is not suitable for the development of water quality standards:
  - TSS-1, page 16: "Some disadvantages of using field-collected data include the lack of control of environmental and process variables."
  - TSS-1, page 17: "Limitations to biological measures inside the wedge are caused by other unmeasured variables (Figure 2). ..."

The commenter uses these quotes to support the argument that field collected data should not be used in any analysis. The statements apply only to challenges that are specific to certain datasets that then lead to the choice of analysis methods for that specific dataset. The statements cannot be generalized to other datasets and other resulting analysis choices. This language was part of the SONAR Book 3, Exhibit TSS-1, and establishes that least squares regression was not appropriate for these datasets of field-collected biological data; which is why the MPCA chose to use quantile regression and changepoint analyses. By pointing out some of the disadvantages of field-collected biological data, the MPCA was demonstrating that certain techniques are better suited for these particular datasets. Quantile regression analysis is particularly powerful as it minimizes the effect of covarying stressors. This method fits the outside of the data plot and thereby provides a better fit for the response of the biological community to the stressor of interest (i.e., total phosphorus, Chl-a, DO flux and BOD<sub>5</sub>). A more detailed description can be found in SONAR Book 2, Exhibit EU-1, p. 26, Figure 11. The changepoint analysis also offers similar advantages of minimizing the effect of covarying stressors over the least squares regression analysis. Figures of the response of the biological community to the stressor of interest using quantile regression and changepoint analyses can be found in SONAR Book 2, Exhibit EU-1, Appendix IV, Figures 1-34.

Footnote continued on next page.

b. 5-day biochemical oxygen demand (BOD<sub>5</sub>) and dissolved oxygen (DO) flux

MPCA responded to many of the aspects of MESERB's request to remove BOD<sub>5</sub> and DO flux as response variables in MPCA's 1/28/14 Response. A few aspects of the request are new. Each aspect is summarized below with citation to previous responses and additional response information.

1. *Comments in HE-8-20 and 20B (MESERB) assert that BOD<sub>5</sub> and DO flux are affected by confounding factors and are therefore unreliable.* MPCA previously responded to this aspect in MPCA's 1/28/14 Response (Attachment I, line 205).<sup>8</sup>
2. *Comments in HE-8-20 and 20B (MESERB) argue that measurements of BOD<sub>5</sub> will result in "false positives" as a result of factors unrelated to nutrient enrichment.* MPCA previously responded to this aspect in MPCA's 1/28/14 Response (Attachment I, line 223<sup>9</sup> and line 216<sup>10</sup>). In addition, neither EPA nor its technical reviewers (SONAR Book 2, Exhibit EU-22b, EU-23b, and EU-24b) raised major issues as to the application of BOD<sub>5</sub> or DO flux in MPCA's analysis or as response criteria in Minnesota's proposed river eutrophication standard. Results from Minnesota's EPA-funded river nutrient studies (which are a technical basis for the proposed criteria) incorporate BOD<sub>5</sub> and DO flux; and results are included in SONAR Book 2, Exhibits EU-2, EU-3 and EU-4. At no point in the grant approval process or the review of the technical reports did EPA indicate that these variables should not be included in the research or as response criteria in the proposed combined standard. Furthermore, MCEA and Dr. Burkholder (HE-8-8e) in their

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Footnote 7, continued.

- 5) *Finally, these biological analyses were not used alone, but rather were supported by other lines of evidence as recommended by the Science Advisory Board (SAB) report (SONAR Book 2, Exhibit EU-20).*

*It is reasonable for MPCA to use the multiple methods outlined as a basis for the river eutrophication and TSS water quality standards. These methods recognize and account for covarying factors."*

<sup>8</sup> *"That is correct. Just as Chl-a is impacted by a number of factors, so are BOD and DO Flux. That is the reason the MPCA has combined these response variables with the phosphorus criteria to yield the river eutrophication standard. This ensures that systems that do not exhibit elevated Chl-a, BOD, or DO flux (indicators of stress to biological communities) will not be listed as impaired."*

<sup>9</sup> *"The use of BOD<sub>5</sub>, as used in development of and as a part of Minnesota's river eutrophication standards, is reasonable and is well supported in Exhibit EU-1 and SONAR Book 2. Combined with Chl-a and DO flux it provides a basis for describing the response of streams to excess phosphorus, as depicted in the conceptual model (Figure 3, SONAR Book 2)."*

<sup>10</sup> *"MESERB has expressed concern with the possible misuse or misapplication of BOD<sub>5</sub> as a part of the river eutrophication standard. As with all monitoring data, MPCA uses professional judgment on sample collection, data interpretation and standards implementation. For example, monitoring conducted by MPCA staff or funded by MPCA is conducted to insure that representative monitoring sites are selected (e.g. for river eutrophication evaluations, sites will not be selected immediately downstream of a WWTF outfall, where it may be possible to have high TP and high BOD<sub>5</sub> that is not a function of river's response to TP). Likewise, in the assessment phase, professional judgment groups review site information to assure that sample collection methods and site selection were appropriate for the river reach (AUID) that is being assessed for compliance with the standard. These considerations are applied to both small and large streams."*



exhaustive reviews of Exhibit EU-1 (HE-8-8) and prior drafts(HE-8-8c) never expressed any misgivings with the use of BOD<sub>5</sub> or diel DO flux as response variables in Minnesota's proposed combined river eutrophication criteria. Rather, their arguments were often that the proposed criteria for BOD<sub>5</sub> and diel DO flux were too high.

3. *Comment HE-8-20B (MESERB), p. 18, erroneously interprets Figure 24 in SONAR Book 2, pg. 84, by suggesting the figure is a measure of the percent of streams that will be found to be impaired in each region.* MPCA never made this claim and the comment indicates a lack of understanding of the proposed eutrophication standard. Some portion of the streams which have total phosphorus that exceeds the regional criterion will not be impaired because along with an exceedance of the phosphorus criteria, it requires a demonstration that excessive suspended algae is occurring over the course of at least 2 growing seasons resulting in a violation of at least one of the response variables.
4. *Comments in HE-8-20, and HE-8-20B and its Attachments 2 and 3 (MESERB) argue that BOD<sub>5</sub> measurements are not accurate as they only measure respiration of algae.* MPCA previously responded to this aspect in MPCA's 1/28/14 Response (Attachment I, line 220).<sup>11</sup> In HE-8-20B, Attachment 2, the author states that BOD<sub>5</sub> is solely the result of respiration by algae and supports this claim by providing references that demonstrate it can require months or years for algae to fully decompose. For decomposition of algae to cause a depletion of dissolved oxygen, the algae does not need to be fully decomposed. Samples that contain live algae also contain dead algae (as represented by the "pheophytin pigments" that are measured in conjunction with chlorophyll-a pigments [SONAR Book 2, Exhibit EU-1, Table 14, pages 42-43]) and dying algae that are decomposed by bacteria in the test bottle over the 5-day period. While part of the BOD<sub>5</sub> measurement is the result of algal respiration, it is not solely responsible for the depletion of dissolved oxygen in the test. In addition, Figure 26 in SONAR Book 2, Exhibit EU-1, demonstrates that BOD<sub>5</sub> is a useful measure for quantifying algal productivity when high levels of suspended algae are present.

Comment HE-8-20 (MESERB) also states that MPCA staff agree the BOD<sub>5</sub> test measures algal respiration and links MPCA staff's response to the statement that "this was duplicative of algal (sic) (DO) flux response criteria because respiration is part of algal (sic) (DO) flux." MPCA staff did not make that connection and do not agree with the statement.

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<sup>11</sup> "Exhibits EU-40 and EU-52a discuss importance of BOD<sub>5</sub> as an important measure when assessing eutrophication impacts. BOD<sub>5</sub> and sestonic Chl-a are highly correlated as demonstrated in Exhibit EU-1 (Figure 26, page 49). Cohen (1990; Attachment VI), in his experiments to assess the role of algae in biochemical oxygen demand, also found that BOD increased linearly with chlorophyll-a concentration. Based on his experiments, he noted "it is reasonable to suggest that the algae died early in the incubation and the oxygen was depleted by bacterial depletion of algae biomass." Hence, while algal respiration does contribute initially to oxygen demand in the BOD test, bacterial decomposition was deemed more important."

5. *Comments in HE-8-20B and its Attachments 2 and 3 (MESERB) assert that the proposed BOD<sub>5</sub> criteria for the North and Central regions are below the detection limit.* This statement is not correct. MPCA provided an initial previous response (1/28/14 Response, Attachment I, line 221). In addition, the detection limit<sup>12</sup> for BOD<sub>5</sub> is largely the result of the detection limit of the dissolved oxygen measurement method. The Minnesota Department of Health (MDH), which is MPCA's contract lab, has a reporting limit of 0.5 mg/L. EPA-approved standard methods do target a DO depletion of >2.0 mg/L, however, readings below 2.0 mg/L can be reported. Based on a query of STORET data in October 2012 the Agency found 12,134 BOD<sub>5</sub> measurements from Minnesota streams. From the 12,134 samples, 5,376 (44 %) were below 2.0 mg/L. Of the 12,134 measurements, 8,275 (68%) samples were analyzed at MDH, with the 0.5 mg/L reporting limit.
6. *Comments in HE-8-20 and HE-8-20B (MESERB) argue that DO flux is variable at low levels.* DO flux can be variable at low levels of suspended chlorophyll-a. High levels of DO flux may at times be the result of unmeasured attached algae (i.e., periphyton unmeasured in suspended Chl-a sampling) or confounding factors such as stream reaeration. However, since DO flux is used as a part of combined criteria this would not be an identified impairment. In such a case, the assessment or stressor identification process would identify a periphyton-caused impairment triggering an assessment using the periphyton criteria, not relying on the DO flux criteria.
7. *Comments in HE-8-20 (MESERB) and HE-8-20B argue that the MPCA did not demonstrate an impact of DO Flux or BOD on biological communities.* MPCA previously responded to this aspect in MPCA's 1/28/14 Response at Attachment IV, Section 1<sup>13</sup>, and Attachment I, line 226.<sup>14</sup> In addition, comment HE-8-20 (MESERB) states that MPCA staff confirmed that BOD<sub>5</sub> is not toxic to darters and that there is no evidence to explain

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<sup>12</sup> Reporting limit is a function of the method detection limit. It is the value the lab is confident in reporting based on standard laboratory procedures and experience with the particular test. Reporting limits are typically higher than detection limits.

<sup>13</sup> "During the Public Hearing on January 8, 2014, John Hall questioned the relationship between biological responses and diel dissolved oxygen (DO) flux. The analyses the MPCA presented in EU-1 were based on a relatively small dataset (fish = 25 sites, macroinvertebrates = 21 sites) and, although some of the patterns were strong, the MPCA agrees that additional work could be performed to better resolve these relationships. The original analyses in EU-1 were performed in 2010 and since this time, the MPCA has collected additional DO flux data as a part of its overall river monitoring efforts. The analyses from EU-1 were repeated with this larger dataset to determine if the original results are supported and if DO flux-biology relationships can be better defined. Updating the dataset increased the sample size for the fish from 25 to 74 sites and for macroinvertebrates from 21 to 61 sites. See EU-1 pp. 26-34 for a description of the methods used to identify thresholds. The number of thresholds that could be identified was increased from 4 to 10 (Tables 1 and 2). The increased sample size clarified some of the relationships and resulted in a greater number of significant results (see Figures 1 and 2). In general, the conclusions drawn from the smaller sample size were accurate and the larger dataset confirms the negative impact of increased DO flux on biological communities."

<sup>14</sup> "The use of diel DO flux or DO range, for purposes of assessing the response of rivers to excess nutrients has precedent with Montana (Exhibit EU-52a & b), Ohio (Exhibit EU-25,-26, HE-8-6), and New Jersey (NJDEP 2010; 2010 Integrated Water Quality Monitoring and Assessment Methods). It is either used as a part of nutrient-related water quality standards or is an integral aspect of river nutrient standards assessment and implementation. In addition, the MPCA has documented a strong relationship between DO diel DO flux and biological responses (Exhibit EU-1 and Section 1 of Attachment IV)."

why darters decreased at high BOD<sub>5</sub> and that this is evidence that BOD<sub>5</sub> as an "improper parameter." MPCA disagrees with this conclusion. The commenter makes an interpolation of BOD<sub>5</sub> using only the Darter metric. MPCA did not use only the darter metric to determine BOD<sub>5</sub> thresholds, but rather, MPCA used the 25<sup>th</sup> percentile of all biological thresholds.

8. *Comment HE-8-20 (MESERB) states that during the 1/8/14 rule hearing the MPCA declared that no technical treatise exists to support the use of BOD<sub>5</sub> as a nutrient impairment indicator.* This characterization of MPCA's response is incorrect. In the hearing transcript (pg. 120, line 23), the MPCA responded that it would provide a response during the comment period. MPCA did not state that no technical treatise exists. SONAR Book 2, Exhibit EU-40 (Mallin et al., 2006) states that "(f)actors contributing to hypoxia in rivers, lakes and streams" makes a strong case for use of BOD<sub>5</sub> and notes direct stimulation of heterotrophic microbial flora by anthropogenic nutrient loading and its contribution to BOD<sub>5</sub>. They also note "an advantage of using BOD<sub>5</sub> in limnological and estuarine assessments is that the standard method is easily performed, repeatable, and widely recognized geographically and across disciplines." MPCA previously responded to this aspect in MPCA's 1/28/14 Response in Attachment I, line 226.<sup>15</sup> Montana (SONAR Book 2, Exhibit EU-52a) also makes mention of the measurement of BOD<sub>5</sub> as a part of their overall river eutrophication assessment approach.

### **C. Comments regarding the use of periphyton as a variable**

Comment HE-8-20 (MESERB) requests that the proposed rule language be revised so that periphyton chlorophyll-a (Chl-a) is not a "stand-alone" variable for the determination of impairment. The MPCA stresses that the proposed eutrophication standards are a combined criteria and that it is essential that the elements be considered holistically and not individually and in isolation from the overall standard. The proposed rules are structured so that each of the response variables is considered in conjunction with elevated phosphorus, and in that sense, none of them are "stand-alone" variables. The MPCA carefully considered the application of periphyton Chl-a as a numeric translator and has presented a discussion of the reasonableness in SONAR Book 2, pgs. 79-80.

SONAR Book 2, pg. 79, states:

*"To complement the river eutrophication standards for sestonic algae, in streams where the algae community is dominated by periphytic algae that grow on rocks and other substrate, the MPCA is proposing a water quality standard to meet the narrative standards prohibiting excess algal growth and slime (Minn. R. 7050.0150). The proposed periphyton water quality standard is designed to augment the proposed sestonic water quality standard in shallow, 1st and 2nd order streams. These streams typically do not*

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<sup>15</sup> Ibid.

*have residence times sufficient to grow sestonic algae but could be susceptible to excessive attached filamentous algae or diatoms."*

The application of this numeric translator also recognizes that there are multiple factors (including excess nutrients) that influence excessive periphyton growth – as depicted in the conceptual diagram (Figure 4, SONAR Book 2, pg. 13). SONAR Book 2, pgs. 89-90, discuss application of the periphyton standard including monitoring, assessment, and stressor identification.

**D. Comments requesting separate standards for large and small rivers**

Comment HE-8-20 (MESERB) states that "in testimony, MPCA agreed small streams perform significantly different than large streams" and that, therefore, it is inappropriate to apply the same water quality standards to both large (non-wadeable) and small (wadeable) streams. The MPCA disagrees with the commenter's representation of staff comments (transcript pg. 112, line 10 –Will Bouchard "*...that was why the analysis wasn't limited just to large streams, because we recognize that just because of the size of the stream doesn't mean you can't have negative impact*") and with the commenter's conclusion that the standards should not apply to both large and small streams. In MPCA's 2/4/14 Rebuttal, Section II. D. b. (pg. 7), the MPCA addressed comments relating to the differences between wadeable and non-wadeable streams.<sup>16</sup>

The MPCA disagrees with the need for different standards applicable to large and small streams and rivers. The basis for applying one standard to rivers and streams was addressed for phosphorus in SONAR Book 2, Exhibit EU-1, pgs. 74-75.<sup>17</sup> In the evaluation to determine if the

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<sup>16</sup> "Comment HE-8-14 (MCSC) and the testimony of John Hall suggested that different standards should be developed for wadeable and nonwadeable streams. As part of their argument, they suggest that the MPCA documented "meaningful and significant differences between large and small streams and rivers." This statement is not correct. No statistically significant differences in the biological thresholds were identified between wadeable and nonwadeable streams within any of the three regions (SONAR Book 2, Exhibit EU-1, Figure 48). While not statistically significant, the nonwadeable streams did have somewhat lower biological thresholds than the wadeable streams. These differences were driven by the physical characteristic of these systems. Specifically, nonwadeable streams are more likely to have the physical conditions (i.e., greater residence time, less shading, etc.) to grow undesirable levels of algae compared to wadeable streams. Despite this, there are wadeable streams in Minnesota that will be negatively impacted by nutrient levels at or above the proposed standard because the physical conditions within these streams are suitable to grow large amounts of algae. For example, despite being a relatively small dataset, there are three wadeable streams in the River Nutrient Study that had measured levels of sestonic chlorophyll between 30-40 µg/L (SONAR Book 2, Exhibit EU-1, Figure 21 included below). However, due to differences in these stream types and the structure of the proposed standard (i.e., inclusion of both the nutrient and response), fewer wadeable streams than nonwadeable streams will be impaired for eutrophication. Regardless, wadeable streams are protected for the aquatic life beneficial uses and it is necessary to have standards to protect the beneficial uses of these systems. Therefore, it is reasonable to apply the same standards to wadeable and nonwadeable streams because they can each have characteristics that are needed to grow large amounts of algae and each require the protection of the proposed standard."

<sup>17</sup> MPCA carefully considered this issue as described in SONAR Book 2, Exhibit EU-1, pgs. 74-75, which states: "...there were no significant differences between the mean total phosphorus concentration thresholds between nonwadeable and wadeable rivers within any of the regions. This suggests that different criteria may not be needed for different stream sizes....As a result, wadeable streams should not be excluded from nutrient standards." This conclusion was repeated in the SONAR Book 2, pg. 54, along with a discussion of how the MPCA considered the differences observed between wadeable and nonwadeable streams.

proposed river eutrophication criteria would support protection of biological goals, available data were used to determine if stream reaches that exceeded the proposed eutrophication met biological criteria (SONAR Book 2, p. 82-86). In this analysis, 33 stream reaches were identified with sufficient data for this analysis. Of those, 14 (42%) were considered wadeable and 13 of these did not meet biological goals. The 13 reaches included 4 that exceeded both the chlorophyll-a and BOD<sub>5</sub> criteria, 5 that exceeded the chlorophyll-a criteria only, and 4 that exceeded the BOD<sub>5</sub> criteria only. This demonstrates that eutrophication issues associated with suspended algal overabundance are present in Minnesota and that the proposed eutrophication criteria are not overprotective in wadeable streams. Based on MPCA's analysis it is reasonable to apply the same river eutrophication standard to large (nonwadeable) and small (wadeable) streams.

The MPCA did not specifically address this issue in SONAR or exhibits for TSS. However, because data is limited for comparing biological endpoints between wadeable and non-wadeable streams, the MPCA does not believe scientific rationale exists for separate TSS standards for large and small rivers and streams.

**E. Comments regarding proposed eutrophication standards for the Red River of the North**

Comment HE-8-20 (MESERB) states that because the datasets used to derive the proposed river eutrophication standards included minimal data from the Red River of the North, the standards should not apply. The MPCA considers this statement to be a misinterpretation of both the process used to develop the standards and how the standards will be implemented. The Red River of the North is different from many other streams in that it does not grow a lot of algae due to the high suspended sediments (i.e., shading). Because of this difference, there may never be an exceedance of the response variables in the proposed river eutrophication standards (Chl-a, BOD<sub>5</sub>, or DO flux) even if high phosphorus levels (stressor variable) exist. However, the river eutrophication standard should apply in the event that conditions change (e.g., reductions in sediment loading) and algae growth increases to cause eutrophication impacts. It is reasonable that the river eutrophication standard apply regardless of whether there is a current impairment.

Comment HE-8-20 (MESERB) states that "*MPCA staff had no answer*" to the question of whether it was proper to limit the application of criteria to exclude the Red River of the North. The MPCA's response was provided in Attachment I (spreadsheet) of the MPCA's 1/28/14 Response. At line 231, the MPCA responded that "*the proposed standards may reasonably be applied to the Red River. Should the assessment process indicate otherwise, the possibility of site specific standards remains.*"

**F. Comments regarding cost analysis**

**a. Cost estimates for implementing river eutrophication standards**

Comment HE-8-20 (MESERB) states that MPCA disregarded estimated costs of implementing the proposed eutrophication standards provided by MESERB and that the estimates provided in the SONAR are not realistic. The MPCA responded directly to comments regarding the cost analysis in its 1/28/14 Response explaining how the Agency has met the statutory directive and established the reasonableness of its estimates. Because Comment HE-8-20 (MESERB) makes specific reference to the costs of implementation relating to “end-of-pipe” effluent limits, the MPCA provides further clarification here. In the SONAR Book 2, pgs. 118-119, MPCA provides a cost estimate associated with implementing effluent limits equivalent to the water quality standard at the end of the pipe. The higher end of the cost range is equivalent to what would be necessary to meet the restrictive low concentration limits in question.

**b. Costs associated with naturally occurring storm events**

Comment HE-8-20 (MESERB) states that the proposed TSS standards will, in effect, regulate naturally occurring conditions resulting in unnecessary expenditures to regulated parties. The comment is based on the incorrect assumption that MPCA treated naturally occurring stormwater events improperly in developing the proposed TSS standard. The MPCA extensively considered how to address naturally occurring stormwater events in the development of the TSS standard. This consideration resulted in the ability to accommodate stormwater events in the TSS standard. The ability to accommodate stormwater events is a major advantage of the proposed standard. In the SONAR Book 3, pgs. 5-6, the MPCA states:

*“Since nonpoint source TSS is driven by storm events, it is not appropriate to focus on daily concentrations. The impact of storm discharges on water quality is a major concern. The current turbidity WQS are not consistent with the storm-induced, flashy nature of how suspended sediments get into surface waters and their dynamics in State waters. With the expansion of the scientific understanding of the impact of stormwater, there is a definite need to amend the turbidity WQS to address the time-related aspect of water quality impacts. The proposed TSS WQS are more technically accurate by accounting for seasonal aspects and frequency of higher TSS events, and recognizes natural variations of TSS in dynamic stream systems. The previous turbidity standards were not fully described in WQS to provide this specificity in protecting the beneficial use.”*

The proposed TSS standard takes into account both high-flow and low-flow conditions, and is based on the overall condition of a stream during the index period, taking into account the whole range of flow and weather conditions. It is neither necessary nor appropriate to have separate standards for separate conditions; the comparison is against the overall condition of reference streams, which exhibit the same range of flow and weather conditions as do the streams to be assessed.

### **III. Response to new issues**

This section addresses two new issues raised by comments in Hearing Exhibits HE-8-20B (MESERB) and HE-8-21 (MSGA).

#### **A. Comment asserting the proposed Total Suspended Solids (TSS) water quality standard is not reasonable because of the effect of VSS on the standard**

Comment HE-8-21 (MSGA) states that the proposed replacement of the current turbidity standard with a Total Suspended Solids standard is not reasonable because volatile suspended solids (VSS) exert an undue influence on Total Suspended Solids (TSS) relative to nonvolatile suspended solids (NVSS). The proposed TSS water quality standard is strongly based in science as discussed in the SONAR Book 3 and exhibits. TSS is comprised of both volatile suspended solids (VSS) and nonvolatile suspended solids (NVSS). The commenter's assertion that VSS occur at higher concentrations as TSS decreases is not valid. TSS is affected by VSS to a smaller degree than TSS is affected by NVSS. Therefore, TSS is more sensitive (more responsive) to reductions in NVSS than it is to VSS. Nonvolatile suspended solids are the primary concern with the TSS water quality standard as specifically noted in Exhibit TSS-6 to SONAR Book 3. The corroborating laboratory studies relied on in Exhibit TSS-6 stressed inorganic particles (NVSS), not organic particles (VSS), as the serious TSS problem. Additional support for the technical basis used to develop the proposed TSS water quality standards is provided by EPA (HE-8-11). The proposed TSS water quality standard is based on sound science as detailed in SONAR Book 3 and is, therefore, reasonable.

The commenter also expressed concern about implementation issues surrounding TSS. The commenter is correct in stating that a numeric translator has been used under the current turbidity water quality standard to develop TSS load calculations for implementation of the turbidity standard. However, it is not correct to make a direct comparison between the quantifiable TSS reported as mg/liter and the non-quantifiable turbidity reading reported as Nephelometric Turbidity Units (NTU), a non-quantifiable measure. Further discussion of implementation of the TSS water quality standards is beyond the scope of this rulemaking.

#### **B. Comment requesting removal of provisions referring to antidegradation (a.k.a. nondegradation) requirements**

Commenter HE-8-20B (MESERB) requests removal of provisions referring to antidegradation (also known as "nondegradation" in Minnesota Rules) requirements from the proposed rule. The need for and reasonableness of referring to antidegradation requirements is directly addressed in SONAR Book 2 on pgs. 90-91. In addition to classifying water bodies according to beneficial uses and establishing numeric and narrative water quality standards aimed at

protecting beneficial uses, the Clean Water Act (CWA) requires all states to adopt antidegradation requirements<sup>18</sup> as the third component of a water quality protection program. The reference to antidegradation requirements in the proposed rule refers to existing provisions already adopted and in place. The proposed language is for clarity only. The language merely makes clear that the current, pre-existing antidegradation requirements in Minn. Rules pts. 7050.0180 and 7050.0185 apply. The antidegradation reference does not establish new authority. The proposed language does not impose a stricter burden than already exists. Because the current antidegradation requirements exist, the SONAR does not address the need for or reasonableness of the antidegradation requirements. The need and reasonableness for the current antidegradation rule was established at the points of adoption and revision to the antidegradation rules.<sup>19</sup> This rulemaking need only establish the need for and reasonableness of referencing the antidegradation provisions. Referencing the antidegradation requirements for clarity is needed and is reasonable.

#### IV. Conclusion

The MPCA has demonstrated through the SONAR, the hearing presentation and oral testimony, and this and previous responses to comments, that the proposed amendments are needed and reasonable.

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<sup>18</sup> Clean Water Act § 101(a), 33 U.S.C. § 1251; 40 C.F.R. § 131.12.

<sup>19</sup> State of Minnesota MPCA Statement of Need In the Matter of Proposed Amendments to the Regulation for the Establishment of Standards of Quality and Purity for Interstate Waters, WPC 15 (September 6, 1973).

State of Minnesota MPCA Statement of Need and Reasonableness (SONAR) In the Matter of the Proposed Revision of 6 MCAR §§ 4.8014 and 4.8024 and Proposed Repeal of 6 MCAR §§4.8015 and 4.8025, Relating to the Standards and Classification of Waters of the State (October 29, 1984), pgs. 7-9.

State of Minnesota MPCA SONAR In the Matter of the Proposed Revisions to the Rules Governing the Classification and Standards for Waters of the State, Minnesota Rules Chapter 7050 (April 27, 1993), pgs. 23 and 32.

MPCA Water Quality Division SONAR Amended Rules Governing Water Quality Standards for Protection of Quality and Purity, Minn. R. 7050.0180, 7050.0185, 7050.0216, 7050.0224, 7050.0460 and 7050.0470; and Proposed New Rules Governing Water Quality Standards, Standard Implementation, and Nondegradation Standards for Great Lakes Initiative Pollutants in the Lake Superior Basin, Minn. R. Ch. 7052 (1997), pgs. 73-74.